

IN THE CLAIMS:

Please cancel Claims 1 to 5, 20 to 25, 30 to 41, 46, 48 to 52, 67 to 72, 77 to 88, 90, 93 and 97 to 102 without prejudice or disclaimer of subject matter. Please amend Claims 6, 42, 47, 53, 89, 91, 94 and 95 as shown below. The claims, as pending in the subject application, read as follows:

1. to 5. (Cancelled)

6. (Currently Amended) A comparison apparatus comprising: An apparatus according to claim 5,

a receiver operable to receive an input signal;

a recognition processor operable to compare said input signal with stored label models to generate a recognised sequence of labels in said input signal and confidence data representative of the confidence that the recognised sequence of labels is representative of said input signal; and

a similarity measure calculator operable to compare said recognised sequence of labels received from said recognition processor with a stored sequence of annotation labels using a combination of i) predetermined confusion data which defines confusability between different labels, and ii) said confidence data received from the recognition processor and representative of the confidence that said received recognized sequence of labels is representative of the input signal, to provide a measure of the similarity between the recognised sequence of labels and the stored sequence of annotation labels,

wherein said similarity measure calculator comprises

an aligner operable to align labels of the recognised sequence of labels with labels of the stored sequence of annotation labels to form a number of aligned pairs of labels;

a comparator operable to compare the labels of each aligned pair of labels using said combination of said predetermined confusion data and said confidence data, to generate a comparison score representative of the similarity between the aligned pair of labels; and

a combiner operable to combine the comparison scores for all the aligned pairs of labels to provide said similarity measure,

wherein said comparator comprises

a first sub-comparator operable to compare, for each aligned pair, the recognised sequence label in the aligned pair with each of a plurality of labels taken from a set of predetermined labels using said confusion data and said confidence data to provide a corresponding plurality of intermediate comparison scores representative of the similarity between said recognised sequence label and the respective labels from the set;

a second sub-comparator operable to compare, for each aligned pair, the stored sequence label in the aligned pair with each of said plurality of labels from the set using said confusion data and said confidence data to provide a further corresponding plurality of intermediate comparison scores representative of the similarity between said stored sequence label and the respective labels from the set; and

a calculator operable to calculate said comparison score for the aligned pair by combining said pluralities of intermediate comparison scores.

7. (Previously Presented) An apparatus according to claim 6, wherein said first and second sub-comparators are operable to compare the recognised sequence label and the stored sequence label respectively with each of the labels in said set of predetermined labels.

8. (Previously Presented) An apparatus according to claim 6, wherein said comparator is operable to generate a comparison score for an aligned pair of labels which represents a probability of confusing the stored sequence label of the aligned pair as the recognised sequence label of the aligned pair.

9. (Previously Presented) An apparatus according to claim 8, wherein said first and second sub-comparators are operable to provide intermediate comparison scores which are indicative of a probability of confusing the corresponding label taken from the set of predetermined labels as the label in the aligned pair.

10. (Previously Presented) An apparatus according to claim 9, wherein said calculator is operable (i) to multiply the intermediate comparison scores obtained when comparing the recognised and stored sequence labels in the aligned pair with the same label from the set to provide a plurality of multiplied intermediate comparison scores; and (ii) to add the resulting multiplied intermediate comparison scores, to calculate said comparison score for the aligned pair.

11. (Previously Presented) An apparatus according to claim 10, wherein each of said labels in said set of predetermined labels has a predetermined probability of

occurring within a sequence of labels and wherein said calculator is operable to weight each of said multiplied intermediate comparison scores with the respective probability of occurrence for the label from the set used to generate the multiplied intermediate comparison scores.

12. (Previously Presented) An apparatus according to claim 11, wherein said calculator is operable to calculate:

$$\sum_{r=1}^n P(q_j | p_r)P(a_i | p_r)P(p_r)$$

where q_j and a_i are an aligned pair of recognised and stored sequence labels respectively; $P(q_j | p_r)$ is the probability of confusing set label p_r as recognised sequence label q_j ; $P(a_i | p_r)$ is the probability of confusing set label p_r as stored sequence label a_i ; and $P(p_r)$ represents the probability of set label p_r occurring in a sequence of labels.

13. (Previously Presented) An apparatus according to claim 12, wherein the confusion probabilities for the recognised and stored sequence labels are determined in advance and depend upon the recognition system that was used to generate the respective recognised and stored sequences.

14. (Previously Presented) An apparatus according to claim 12, wherein said calculator is operable to calculate $P(q_j | p_r)$ using said confusion data and said confidence data.

15. (Previously Presented) An apparatus according to claim 14, wherein said calculator is operable to take a weighted combination of said confusion data and said confidence data to determine $P(q_j | p_r)$.

16. (Previously Presented) An apparatus according to claim 15, wherein said confusion data is obtained from a training session in which a large amount of input signals for which the label content is known are processed by said recognition processor and wherein said calculator is operable to weight said confidence data for a current label in dependence upon the amount of training data available for the current label in said training session.

17. (Previously Presented) An apparatus according to claim 16, wherein said calculator is operable to calculate:

$$P(q_j | p_r) = \frac{b_c c_{jr} + b_e e^{r_{qj}} + \beta}{b_c n_r + b_e + N_p \beta}$$

where c_{jr} and n_r are counts generated during the training session for the number of times the recognition processor decoded label q_j when it should have decoded label p_r and the number of times the recognition processor decoded anything when it should have decoded label p_r , respectively; $e^{r_{qj}}$ is the confidence data associated with the recognised sequence label of the aligned pair which is associated with the set label P_r ; β represents a lower limit of the confidence probabilities; N_p is the total number of labels in the set; and b_c and b_e are scaling factors which are applied to the confusion data and the confidence data respectively.

18. (Previously Presented) An apparatus according to claim 10, wherein said intermediate comparison scores represent log probabilities and wherein said calculator is operable to perform said multiplication by adding the respective intermediate comparison scores and is operable to perform said addition of said multiplied scores by performing a log addition calculation.

19. (Previously Presented) An apparatus according to claim 18, wherein said combiner is operable to add the comparison scores for all the aligned pairs to determine said similarity measure.

20. to 25. (Cancelled)

26. (Previously Presented) An apparatus according to claim 6, wherein each of the labels in said recognised and stored sequences of labels belong to said set of predetermined labels.

27. (Previously Presented) An apparatus according to claim 26, wherein said confusion data comprises, for each label in the set of labels, the number of times the recognition processor decodes the label when it should have decoded a different label, for each different label, and the number of times the recognition processor decodes anything when it should have decoded the different label, for each different label.

28. (Previously Presented) An apparatus according to claim 27, wherein said predetermined confusion data further comprises, for each label in the set of labels, the probability of inserting the label in a sequence of labels.

29. (Previously Presented) An apparatus according to claim 26, wherein said predetermined confusion data further comprises, for each label in the set of labels, the probability of deleting the label from a sequence of labels.

30. to 41. (Cancelled)

42. (Currently Amended) A comparison apparatus comprising: An apparatus according to claim 40,

a receiver operable to receive an input signal;
a recognition processor operable to compare said input signal with stored
label models to generate a recognised sequence of labels in said input signal and
confidence data representative of the confidence that the recognised sequence of labels is
representative of said input signal; and

a similarity measure calculator operable to compare said recognised
sequence of labels received from said recognition processor with a stored sequence of
annotation labels using a combination of i) predetermined confusion data which defines
confusability between different labels, and ii) said confidence data received from the
recognition processor and representative of the confidence that said received recognized
sequence of labels is representative of the input signal, to provide a measure of the

similarity between the recognised sequence of labels and the stored sequence of annotation labels.

wherein said comparator is operable to compare said recognised sequence of labels with a plurality of stored sequences of labels using said confusion data and said confidence data to provide a respective measure of the similarity between the recognised sequence of labels and said plurality of stored sequences of labels,

wherein said comparator comprises a normaliser operable to normalise each of said similarity measures,

wherein said normaliser is operable to normalise each similarity measure by dividing each similarity measure by a respective normalisation score which varies in dependence upon the length of the corresponding stored sequence of annotation labels

wherein said comparator comprises

a first sub-comparator operable to compare, for each aligned pair, the recognised sequence label in the aligned pair with each of a plurality of labels taken from a set of predetermined labels using said confusion data and said confidence data to provide a corresponding plurality of intermediate comparison scores representative of the similarity between said recognised sequence label and the respective labels from the set;

a second sub-comparator operable to compare, for each aligned pair, the stored sequence label in the aligned pair with each of said plurality of labels from the set using said confusion data and said confidence data to provide a further corresponding plurality of intermediate comparison scores representative of the similarity between said stored sequence label and the respective labels from the set; and

a calculator operable to calculate said comparison score for the aligned pair by combining said pluralities of intermediate comparison scores; and

wherein said respective normalisation scores vary with the corresponding intermediate comparison scores calculated by said second sub-comparator.

43. (Previously Presented) An apparatus according to claim 42, wherein said aligner is operable to align said recognised and stored sequences of labels using a dynamic programming technique and wherein said normaliser is operable to calculate the respective normalisation scores during the progressive calculation of said possible alignments by said aligner.

44. (Previously Presented) An apparatus according to claim 43, wherein said normaliser is operable to calculate, for each possible aligned pair of labels:

$$\sum_{r=1}^n P(a_i | p_r)P(p_r)$$

where $P(a_i | p_r)$ represents the probability of confusing set label p_r as stored sequence label a_i and $P(p_r)$ represents the probability of set label p_r occurring in a sequence of labels.

45. (Previously Presented) An apparatus according to claim 44, wherein said normaliser is operable to calculate said respective normalisations by multiplying the normalisation terms calculated for the respective aligned pairs of labels.

46. (Cancelled)

47. (Currently Amended) An apparatus according to claim 46, An apparatus for searching a database comprising a plurality of information entries to identify information to be retrieved therefrom, each of said plurality of information entries having an associated annotation comprising a sequence of labels, the apparatus comprising:

a label comparison apparatus for comparing a query sequence of labels obtained from an input query with the labels of each annotation to provide a set of comparison results, wherein the label comparison apparatus comprises a receiver operable to receive an input signal, a recognition processor operable to compare said input signal with stored label models to generate a recognised sequence of labels in said input signal and confidence data representative of the confidence that the recognised sequence of labels is representative of said input signal, a similarity measure calculator operable to compare said recognised sequence of labels received from said recognition processor with a stored sequence of annotation labels using a combination of i) predetermined confusion data which defines confusability between different labels, and ii) said confidence data received from the recognition processor and representative of the confidence that said received recognized sequence of labels is representative of the input signal, to provide a measure of the similarity between the recognised sequence of labels and the stored sequence of annotation labels.; and

an information identifier operable to identify said information to be retrieved from said database using said comparison results,

wherein said label comparison apparatus has a plurality of different comparison modes of operation and wherein the apparatus further comprises

a determiner operable to determine if the sequence of labels of a current annotation was generated from an audio signal or from text, and for outputting a determination result; and

a selector operable to select, for the current annotation, the mode of operation of said label comparison apparatus in dependence upon said determination result.

48. to 52. (Cancelled)

53. (Currently Amended) A label comparison method comprising: A method according to claim 52;

receiving an input signal;

a recognition processing step of comparing said input signal with stored label models to generate a recognised sequence of labels in said input signal and confidence data representative of the confidence that the recognised sequence of labels is representative of said input signal; and

calculating a measure of the similarity between the recognised sequence of labels generated in said recognition processing step and a stored sequence of annotation labels by comparing said recognised sequence of labels with the stored sequence of annotation labels using a combination of i) predetermined confusion data which defines confusability between different labels, and ii) said confidence data generated in said recognition processing step and representative of the confidence that the recognised sequence of labels is representative of said input signal,

wherein said calculating step comprises

aligning labels of the recognised sequence of labels with labels of the stored sequence of annotation labels to form a number of aligned pairs of labels;

comparing the labels of each aligned pair of labels using said predetermined confusion data and said confidence data, to generate a comparison score representative of the similarity between the aligned pair of labels; and

combining the comparison scores for all the aligned pairs of labels to provide said similarity measure,

wherein said comparing step comprises

a first sub-comparing step of comparing, for each aligned pair, the recognised sequence label in the aligned pair with each of a plurality of labels taken from a set of predetermined labels using said confusion data and said confidence data to provide a corresponding plurality of intermediate comparison scores representative of the similarity between said recognised sequence label and the respective labels from the set;

a second sub-comparing step of comparing, for each aligned pair, the stored sequence label in the aligned pair with each of said plurality of labels from the set using said confusion data and said confidence data to provide a further corresponding plurality of intermediate comparison scores representative of the similarity between said stored sequence label and the respective labels from the set; and

a step of calculating said comparison score for the aligned pair by combining said pluralities of intermediate comparison scores.

54. (Previously Presented) A method according to claim 53, wherein said first and second sub-comparing steps compare the recognised sequence label and the

stored sequence label respectively with each of the labels in said set of predetermined labels.

55. (Previously Presented) A method according to claim 53, wherein said comparing step generates a comparison score for an aligned pair of labels which represents a probability of confusing the stored sequence label of the aligned pair as the recognised sequence label of the aligned pair.

56. (Previously Presented) A method according to claim 55, wherein said first and second sub-comparing steps provide intermediate comparison scores which are indicative of a probability of confusing the corresponding label taken from the set of predetermined labels as the label in the aligned pair.

57. (Previously Presented) A method according to claim 56, wherein said calculating step (i) multiplies the intermediate scores obtained when comparing the recognised and stored sequence labels in the aligned pair with the same label from the set to provide a plurality of multiplied intermediate comparison scores; and (ii) adds the resulting multiplied intermediate scores, to calculate said comparison score for the aligned pair.

58. (Previously Presented) A method according to claim 57, wherein each of said labels in said set of predetermined labels has a predetermined probability of occurring within a sequence of labels and wherein said calculating step weights each of said multiplied intermediate comparison scores with the respective probability of

occurrence for the label from the set used to generate the multiplied intermediate comparison scores.

59. (Previously Presented) A method according to claim 58, wherein said calculating step calculates:

$$\sum_{r=1}^n P(q_j | p_r)P(a_i | p_r)P(p_r)$$

where q_j and a_i are an aligned pair of recognised and stored sequence labels respectively; $P(q_j | p_r)$ is the probability of confusing set label p_r as recognised sequence label q_j ; $P(a_i | p_r)$ is the probability of confusing set label p_r as stored sequence label a_i ; and $P(p_r)$ represents the probability of set label p_r , occurring in a sequence of labels.

60. (Previously Presented) A method according to claim 59, wherein the confusion probabilities for the recognised and stored sequence labels are determined in advance and depend upon the recognition system that was used to generate the respective recognised and stored sequences.

61. (Previously Presented) A method according to claim 59, wherein said calculating step calculates $P(q_j | p_r)$ using said confusion data and said confidence data.

62. (Previously Presented) A method according to claim 61, wherein said calculating step takes a weighted combination of said confusion data and said confidence data to determine $P(q_j | p_r)$.

63. (Previously Presented) A method according to claim 62, wherein said confusion data is obtained from a training session in which a large amount of input signals for which the label content is known are processed by said recognition processing step and wherein said calculating step weights said confidence data for a current label in dependence upon the amount of training data available for the current label in said training session.

64. (Previously Presented) A method according to claim 63, wherein said calculating step calculates:

$$P(q_j|p_r) = \frac{b_c c_{jr} + b_e e^{r_{qj}} + \beta}{b_c n_r + b_e + N_p \beta}$$

where c_{jr} and n_r are counts generated during the training session for the number of times the recognition processing step decoded label q_j when it should have decoded label p_r and the number of times the recognition processing step decoded anything when it should have decoded label p_r , respectively; $e^{r_{qj}}$ is the confidence data associated with the recognised sequence label of the aligned pair which is associated with the set label P_r ; β represents a lower limit of the confidence probabilities; N_p is the total number of labels in the set; and b_c and b_e are scaling factors which are applied to the confusion data and the confidence data respectively.

65. (Original) A method according to claim 57, wherein said intermediate scores represent log probabilities and wherein said calculating step performs said multiplication by adding the respective intermediate scores and performs said addition of said multiplied scores by performing a log addition calculation.

66. (Previously Presented) A method according to claim 65, wherein said combining step adds the comparison scores for all the aligned pairs to determine said similarity measure.

67. to 72. (Cancelled)

73. (Previously Presented) A method according to claim 53, wherein each of the labels in said recognised and stored sequences of labels belong to said set of predetermined labels.

74. (Previously Presented) A method according to claim 73, wherein said confusion data comprises, for each label in the set of labels, the number of times the recognition processing step decodes the label when it should have decoded a different label, for each different label, and the number of times the recognition processing step decodes anything when it should have decoded the different label, for each different label.

75. (Previously Presented) A method according to claim 74, wherein said predetermined data further comprises, for each label in the set of labels, the probability of inserting the label in a sequence of labels.

76. (Previously Presented) A method according to claim 74, wherein said predetermined data further comprises, for each label in the set of labels, the probability of deleting the label from a sequence of labels.

77. to 88. (Cancelled)

89. (Currently Amended) A label comparison method comprising; A method according to claim 87,

receiving an input signal;

a recognition processing step of comparing said input signal with stored label models to generate a recognised sequence of labels in said input signal and confidence data representative of the confidence that the recognised sequence of labels is representative of said input signal; and

calculating a measure of the similarity between the recognised sequence of labels generated in said recognition processing step and a stored sequence of annotation labels by comparing said recognised sequence of labels with the stored sequence of annotation labels using a combination of i) predetermined confusion data which defines confusability between different labels, and ii) said confidence data generated in said recognition processing step and representative of the confidence that the recognised sequence of labels is representative of said input signal,

wherein said comparing step compares said recognised sequence of labels with a plurality of stored sequences of labels using said confusion data and said confidence data to provide a respective measure of the similarity between the recognised sequence of labels and said plurality of stored sequences of labels,

wherein said comparing step comprises a normalising step for normalising each of said similarity measures,

wherein said normalising step normalises each similarity measure by dividing each similarity measure by a respective normalisation score which varies in dependence upon the length of the corresponding stored sequence of annotation labels,

wherein said comparing step comprises
a first sub-comparing step of comparing, for each aligned pair, the recognised sequence label in the aligned pair with each of a plurality of labels taken from a set of predetermined labels using said confusion data and said confidence data to provide a corresponding plurality of intermediate comparison scores representative of the similarity between said recognised sequence label and the respective labels from the set;

a second sub-comparing step of comparing, for each aligned pair, the stored sequence label in the aligned pair with each of said plurality of labels from the set using said confusion data and said confidence data to provide a further corresponding plurality of intermediate comparison scores representative of the similarity between said stored sequence label and the respective labels from the set; and

a step of calculating said comparison score for the aligned pair by combining said pluralities of intermediate comparison scores;

and wherein said respective normalisation scores vary with the corresponding intermediate comparison scores calculated by said second sub-comparing step.

90. (Cancelled)

91. (Currently Amended) A label comparison method comprising: A method according to claim 90;

receiving an input signal;

a recognition processing step of comparing said input signal with stored label models to generate a recognised sequence of labels in said input signal and confidence data representative of the confidence that the recognised sequence of labels is representative of said input signal; and

calculating a measure of the similarity between the recognised sequence of labels generated in said recognition processing step and a stored sequence of annotation labels by comparing said recognised sequence of labels with the stored sequence of annotation labels using a combination of i) predetermined confusion data which defines confusability between different labels, and ii) said confidence data generated in said recognition processing step and representative of the confidence that the recognised sequence of labels is representative of said input signal

wherein said comparing step compares said recognised sequence of labels with a plurality of stored sequences of labels using said confusion data and said confidence data to provide a respective measure of the similarity between the recognised sequence of labels and said plurality of stored sequences of labels

wherein said comparing step comprises a normalising step for normalising each of said similarity measures

wherein said aligning step comprises a dynamic programming step for aligning said recognised and stored sequences of labels using a dynamic programming technique and wherein said normalising step calculates the respective normalisation scores during the progressive calculation of said possible alignments by said dynamic programming step

wherein said normalising step calculates, for each possible aligned pair of labels

$$\sum_{r=1}^n P(a_i | p_r)P(p_r)$$

where $P(a_i | p_r)$ represents the probability of confusing set label p_r as stored sequence label a_i and $P(p_r)$ represents the probability of set label p_r occurring in a sequence of labels.

92. (Previously Presented) A method according to claim 91, wherein said normalising step calculates said respective normalisations by multiplying the normalisation terms calculated for the respective aligned pairs of labels.

93. (Cancelled)

94. (Currently Amended) ~~A method according to claim 93, A method of searching a database comprising a plurality of information entries to identify information to be retrieved therefrom, each of said plurality of information entries having an associated annotation comprising a sequence of labels, the method comprising:~~

a label comparison method for comparing a query sequence of labels obtained from an input query with the labels of each annotation to provide a set of comparison results, wherein the label comparison method comprises the steps of receiving an input signal, a recognition processing step of comparing said input signal with stored label models to generate a recognised sequence of labels in said input signal and confidence data representative of the confidence that the recognised sequence of labels is

representative of said input signal, and calculating a measure of the similarity between the
recognised sequence of labels generated in said recognition processing step and a stored
sequence of annotation labels by comparing said recognised sequence of labels with the
stored sequence of annotation labels using a combination of i) predetermined confusion
data which defines confusability between different labels, and ii) said confidence data
generated in said recognition processing step and representative of the confidence that the
recognised sequence of labels is representative of said input signal; and
a step of identifying said information to be retrieved from said database
using said comparison results.

wherein said label comparison method has a plurality of different
comparison modes of operation and in that the method further comprises the steps of
determining if the sequence of labels of a current annotation was generated
from an audio signal or from text, and outputting a determination result; and
selecting, for the current annotation, the mode of operation of said label
comparison method in dependence upon said determination result.

95. (Currently Amended) A method according to claim 93, A method of
searching a database comprising a plurality of information entries to identify information to
be retrieved therefrom, each of said plurality of information entries having an associated
annotation comprising a sequence of labels, the method comprising:
a label comparison method for comparing a query sequence of labels
obtained from an input query with the labels of each annotation to provide a set of
comparison results, wherein the label comparison method comprises the steps of receiving
an input signal, a recognition processing step of comparing said input signal with stored

label models to generate a recognised sequence of labels in said input signal and
confidence data representative of the confidence that the recognised sequence of labels is
representative of said input signal, and calculating a measure of the similarity between the
recognised sequence of labels generated in said recognition processing step and a stored
sequence of annotation labels by comparing said recognised sequence of labels with the
stored sequence of annotation labels using a combination of i) predetermined confusion
data which defines confusability between different labels, and ii) said confidence data
generated in said recognition processing step and representative of the confidence that the
recognised sequence of labels is representative of said input signal; and
a step of identifying said information to be retrieved from said database
using said comparison results,

wherein one or more of said information entries is the associated annotation.

96. to 102. (Canceled)